UNITED STATES PATENT AND TRADEMARK OFFICE

APPLICATION NO.	FILING DATE	FIRST NAMED INVENTOR	ATTORNEY DOCKET NO.	CONFIRMATION NO.
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Please find below and/or attached an Office communication concerning this application or proceeding.

	Application No.	Applicant(s)
Office Action Summary	10/619,634	LEWIS, RUSSELL L.
	Examiner	Art Unit	
	Patrick A. Darno	2163	

-- The MAILING DATE of this communication appears on the cover sheet with the correspondence address --

Period for Reply

A SHORTENED STATUTORY PERIOD FOR REPLY IS SET TO EXPIRE <u>3</u> MONTH(S) OR THIRTY (30) DAYS, WHICHEVER IS LONGER, FROM THE MAILING DATE OF THIS COMMUNICATION.
- Extensions of time may be available under the provisions of 37 CFR 1.136(a). In no event, however, may a reply be timely filed after SIX (6) MONTHS from the mailing date of this communication.
- If NO period for reply is specified above, the maximum statutory period will apply and will expire SIX (6) MONTHS from the mailing date of this communication.
- Failure to reply within the set or extended period for reply will, by statute, cause the application to become ABANDONED (35 U.S.C. § 133). Any reply received by the Office later than three months after the mailing date of this communication, even if timely filed, may reduce any earned patent term adjustment. See 37 CFR 1.704(b).

Status

1)☒ Responsive to communication(s) filed on *15 July 2003*.

2a)☐ This action is **FINAL**. 2b)☒ This action is non-final.

3)☐ Since this application is in condition for allowance except for formal matters, prosecution as to the merits is closed in accordance with the practice under *Ex parte Quayle*, 1935 C.D. 11, 453 O.G. 213.

Disposition of Claims

4)☒ Claim(s) *1-17* is/are pending in the application.

    4a) Of the above claim(s) _____ is/are withdrawn from consideration.

5)☐ Claim(s) _____ is/are allowed.

6)☒ Claim(s) *1-17* is/are rejected.

7)☐ Claim(s) _____ is/are objected to.

8)☐ Claim(s) _____ are subject to restriction and/or election requirement.

Application Papers

9)☐ The specification is objected to by the Examiner.

10)☒ The drawing(s) filed on *15 July 2003* is/are: a)☒ accepted or b)☐ objected to by the Examiner.

    Applicant may not request that any objection to the drawing(s) be held in abeyance. See 37 CFR 1.85(a).

    Replacement drawing sheet(s) including the correction is required if the drawing(s) is objected to. See 37 CFR 1.121(d).

11)☐ The oath or declaration is objected to by the Examiner. Note the attached Office Action or form PTO-152.

Priority under 35 U.S.C. § 119

12)☐ Acknowledgment is made of a claim for foreign priority under 35 U.S.C. § 119(a)-(d) or (f).

    a)☐ All b)☐ Some * c)☐ None of:

      1.☐ Certified copies of the priority documents have been received.

      2.☐ Certified copies of the priority documents have been received in Application No. _____.

      3.☐ Copies of the certified copies of the priority documents have been received in this National Stage application from the International Bureau (PCT Rule 17.2(a)).

    * See the attached detailed Office action for a list of the certified copies not received.

Attachment(s)

1) ☒ Notice of References Cited (PTO-892)

2) ☐ Notice of Draftsperson's Patent Drawing Review (PTO-948)

3) ☒ Information Disclosure Statement(s) (PTO-1449 or PTO/SB/08)
    Paper No(s)/Mail Date *01052006*.

4) ☐ Interview Summary (PTO-413)
    Paper No(s)/Mail Date. _____ .

5) ☐ Notice of Informal Patent Application (PTO-152)

6) ☐ Other: _____.

DETAILED ACTION

1.   Claims 1-17 are pending in this office action.

Claim Rejections - 35 USC § 112

The following is a quotation of the second paragraph of 35 U.S.C. 112:

> The specification shall conclude with one or more claims particularly pointing out and distinctly claiming the subject matter which the applicant regards as his invention.

2.   Claims 4, 5, 7, and 14 are rejected under 35 U.S.C. 112, second paragraph, as being indefinite for failing to particularly point out and distinctly claim the subject matter which applicant regards as the invention.

Claim 4 is rejected because the phrase "it was destroyed" lacks positive antecedent basis and therefore renders the claim indefinite. As a result of the indefinite wording of the claim, it is unclear as to whether the second object, first object or pointer was destroyed. For clarification of the record, the examiner assumes that the pointer was destroyed. Appropriate clarification and correction is required.

Claim 5 is rejected because the phrase "it was reset to point to another object" lacks positive antecedent basis and therefore renders the claim indefinite. As a result of the indefinite wording, it is unclear whether the second object, first object, or the pointer was reset to point to another object. For clarification of the record, the examiner assumes that the pointer was reset to point to another object. Appropriate correction and clarification is required.

Claim 7 is rejected because the phrase "**the objects processed**" lacks positive antecedent basis. This claim uses the phrase "**the objects processed**" when referring to the objects of claim 1. However, the objects of claim one are never processed.

Claim one simply determines which objects are to be processed, but never processes

the objects. Therefore the phrase "**the objects processed**" refers to unknown

processed objects that lack positive antecedent basis in preceding claims rendering

claim 7 indefinite.

Claim 14 is rejected because of the phrase "**any** valid depth value" fails to

particularly point out and distinctly claim the subject matter in such a way that allows

one of ordinary skill in the art to make and use the claimed invention. The definition of

any in the American Heritage College Dictionary is one, some, every, or all without

specification. This is clearly indefinite and requires appropriate clarification and

correction.

Claim Rejections - 35 USC § 101

35 U.S.C. 101 reads as follows:

Whoever invents or discovers any new and useful process, machine, manufacture, or composition of matter, or any new and useful improvement thereof, may obtain a patent therefor, subject to the conditions and requirements of this title.

3.   Claims 1-6 and 8-17 are rejected under 35 U.S.C. 101 because the claimed

invention as a whole fails to provide a useful, concrete, and tangible result.

Claims 1, 16, and 17 describe determining if an object might be garbage (i.e.

"identifying which of the plurality of objects are to be processed to determine whether or

not they are garbage.). However, determining if something "might" happen is not

indicative of a tangible result. Clear and precise steps need to be given in order to

show a tangible result. In this case clear steps would be the actual steps carried out to

determine if the object is garbage and the tangible result would be that the objects are

processed. Because neither the concrete steps of the process nor the useful and

tangible result were cited, claims 1, 16, and 17 are rejected as being non-statutory

under 35 U.S.C. 101. Appropriate correction is required.

Claim 16 is again rejected under 35 U.S.C. 101 because the claim does not

specify that the computer program product be embodied on a computer readable

medium. A computer program product that is not embodied on an acceptable computer

readable medium is nothing more than an abstract idea. When the computer program

product is recorded on an acceptable computer readable medium it becomes

structurally and functionally interrelated to the medium and will be statutory in most

cases since use of technology permits the function of the computer program product to

be realized. Appropriate correction is required.

Claims 2-6, and 8-17 either contain or inherit the deficiencies of claims 1, 16, and

17. Appropriate correction is required.

Claim Rejections - 35 USC § 103

The following is a quotation of 35 U.S.C. 103(a) which forms the basis for all

obviousness rejections set forth in this Office action:

> (a) A patent may not be obtained though the invention is not identically disclosed or described as set
> forth in section 102 of this title, if the differences between the subject matter sought to be patented and
> the prior art are such that the subject matter as a whole would have been obvious at the time the
> invention was made to a person having ordinary skill in the art to which said subject matter pertains.
> Patentability shall not be negatived by the manner in which the invention was made.

4.   Claims 1-6 and 8-17 are rejected under 35 U.S.C. 103(a) as being unpatentable

over the admitted prior art of U.S. Patent Application Publication Number 2002/0087590

issued to David Francis Bacon et al. (hereinafter "Bacon Prior Art") in further view of

U.S. Patent Number 6,338,159 issued to William Preston Alexander, III et al.

(hereinafter "Alexander").

Claim 1:

Bacon Prior Art discloses a garbage collecting method for a memory resource in a computer system, comprising:

for each of a plurality of objects in the memory resource, maintaining a reference count based on a number of objects pointing thereto (Bacon Prior Art: paragraph [0004], lines 11-15; Note that the reference uses a reference count to track object references and further maintains the reference count through continual increments and decrements.),

identifying, based on the associated reference count, which of the plurality of objects are to be processed to determine whether or not they are garbage (Bacon Prior Art: paragraph [0004], lines 11-15; If an object has no references pointing to it, then the object is garbage. It is further noted that this limitation is not given patentable weight because it sets forth an intended use.).

Bacon Prior Art does not explicitly disclose maintaining a depth value based on a distance from a global data object; and identifying, based on the associated reference count, which of the plurality of objects are to be processed to determine whether or not they are garbage. However, Alexander discloses:

maintaining a depth value based on a distance from a global object data (Alexander: column 5, lines 24-27 and Figs 4-5; The invention presented by Alexander maintains a level (depth) value for each node based on the number of levels (or the depth) that separate that node from the root object (global data object). Note Fig. 1 and

column 9, lines 32-48 for the computer program product and computer system claims.);
and

identifying based on the associated depth value, which of the plurality of objects
are to be processed to determine whether or not they are garbage (Alexander: column
5, lines 24-27 and Figs 4-5; This reference discloses an invention capable of
maintaining a depth (level) value that is capable of being used to identify whether or not
an item is garbage. Further, as noted above, this limitation is given no patentable weight
because it sets forth an intended use. Note Fig. 1 and column 9, lines 32-48 for the
computer program product and computer system claims.)

It would have been obvious to one of ordinary skill in the art at the time the
invention was made to modify the teachings Bacon Prior Art with teachings of Alexander
noted above to create a system to identify garbage based on a reference count **and** a
depth value. The skilled artisan would have been motivated to improve the teachings of
Bacon Prior Art per the above such that the level (or depth) value generated by tracing
could be used in the memory allocation and deallocation process (Alexander: column 2,
lines 42-43).

Claim 2:

The combination of Bacon Prior Art and Alexander discloses all the elements of
claim 1, as noted above, and Alexander further discloses wherein:

for each object, the depth value is maintained by providing a depth field in
metadata associated with the object (Alexander: Fig. 5, 130; The Level (depth) column
is metadata for the traced object.).

Claim 3:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 1, as noted above, and Bacon Prior Art further discloses a first of the objects is identified to be processed when it is determined that a second of the objects previously pointing thereto is no longer pointing thereto (Bacon Prior Art [0013], lines 1-12 and Fig. 2).

Bacon Prior Art does not explicitly disclose wherein the depth value of the second object is one less than the depth value of the first object. However, Alexander discloses wherein the depth value of the second object is one less than the depth value of the first object (Alexander: Fig. 5, column 130). It would have been obvious to one of ordinary skill in the art at the time the invention was made to modify the invention of Bacon Prior Art with the teachings of Alexander noted above for the purpose of using both a reference count and a depth value in the garbage collecting process. The skilled artisan would have been motivated to improve the invention of Bacon Prior Art per the above such that the level (or depth) value generated by tracing could be used in the memory allocation and deallocation process (Alexander: column 2, lines 42-43).

Claim 4:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 3, as noted above, and Bacon Prior Art further discloses the second object is no longer pointing to the first object because it was destroyed (Bacon Prior Art: paragraph [0013], lines 1-3; When the program removes the references the reference from the second object to the first object is deleted or destroyed.)

Claim 5:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 3, as noted above, and Bacon Prior Art further discloses the second object is no

longer pointing to the first object because it was reset to point to another object (Bacon

Prior Art: paragraph [0013], 1-3; When the program removes the references, the

references are reset).

Claim 6:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Alexander further discloses wherein the distance for each

of the plurality of objects is based on a number of objects linking the each of the plurality

of objects to the global data object (Alexander: Fig. 4 and Fig. 5 and column 5, 24-27;

The level (or distance) of each node (object) is based on the number of links to the root

of the tree.).

Claim 8:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 1, as noted above, and Alexander further discloses initializing the depth value of a

new object created at runtime to one more than the depth value of an object that points

to the new object and links the new object to the global data object (Alexander: Fig. 4

and Fig. 5 and column 5, lines 24-27; Note that every new object (node) in the tree has

an increasing level count as shown by the table in Fig. 5.).

Claim 9:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 1, as noted above, and Bacon Prior Art further discloses when a particular one of the objects that is processed is determined to be garbage, its associated portion of the memory resource is made available for re-allocation (Bacon Prior Art: paragraph [0013], lines 7-12; The phrase "node may be removed" indicates that the node was recognized as garbage and will be removed from memory. When the garbage is removed from memory the memory resource is effectively available for re-allocation. This is the purpose of garbage collection and this fact is very well known in the art.).

Claim 10:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 1, as noted above, and Alexander further discloses wherein when a particular one of the objects that is processed is determined to be non-garbage, its depth value, and the depth values of other ones of the objects that are pointed to by the particular object and linked to the global data object thereby, are reset (Alexander: column 5, lines 24-27 and Fig. 5; By resetting the depth (level) value of the root object in Fig. 4 and Fig. 5, the depth value of all the objects pointed to by that object would also reset. This is because the root would initialize to zero and the nodes the root points to will have a level (or depth) value that counts up from zero.)

Claim 11:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 10, as noted above, and Alexander further discloses the depth values of objects

that are pointed to by the other ones of the objects whose depth values are reset, and

linked to the global data object thereby, are also reset (Alexander: column 5, lines 24-27

and Fig. 5; Same reasoning as rejection for claim 10.).

Claim 12:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 10, as noted above, and Bacon Prior Art further discloses wherein the particular

object is determined to be non-garbage when it is accessible to outside objects (Bacon

Prior Art: paragraph [0003], lines 1-3 and paragraph [0004], lines 11-15; These

references give clear definitions of what is garbage. Clearly "garbage" is something that

is **not** accessible to outside objects. So all objects that **are** accessible by outside

objects are non-garbage. This is very well known in the art.).

Claim 13:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 10, as noted above, and Alexander further discloses when a new link is created

from a first object of the plurality of objects to a second object of the plurality of objects,

and the first object has a valid depth value but the second object does not have a valid

depth value, the depth value of the second object is initialized to one more than the

depth value of the first object (Alexander: column 5, lines 24-27 and Fig. 4 and Fig. 5;

Note the reference particularly states "counting from the root level zero". And further

note Fig. 5 which shows the depth (level) value of each additional node increasing by one for each link to the next object.).

Claim 14:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 1, as noted above, and Alexander further discloses initializing a depth value of the global object to any valid depth value (Alexander: column 5, lines 24-27 and Fig. 5; Both of these references display initializing the global object (root) to a depth (level) of 0.).

Claim 15:

The combination of Bacon Prior Art and Alexander discloses all the elements of claim 12, as noted above, and Alexander further discloses initializing depth values of the plurality of objects to a specified value (Alexander: column 5, lines 24-27; These references show that the depth value of objects are initialized to one more than the depth value of the object linked to it. Note especially "counting from the root as level zero" and also Fig. 4 and Fig. 5.).

Claim 16:

Claim 16 is a computer program product claim corresponding to method claim 1 and is rejected under the same reasons set forth in claim 1.

Claim 17:

Claim 17 is a computer system claim corresponding to method claim 1 and is rejected under the same reasons set forth in claim 1.

5.   Claim 7 is rejected under 35 U.S.C. 103(a) as being unpatentable over Bacon

Prior Art in view of Alexander and further in view of U.S. Patent Application Publication

Number 2002/0087590 issued to David Francis Bacon et al. (hereinafter "Bacon").

Claim 7:

The combination of Bacon Prior Art and Alexander discloses all the elements of

claim 6, as noted above, but does not explicitly disclose the objects processed to

determine whether or not they are garbage are processed by a loop detection

mechanism for a reference counting garbage collector. However, Bacon discloses the

objects processed to determine whether or not they are garbage are processed by a

loop detection mechanism for a reference counting garbage collector (Bacon: paragraph

[0019], lines 1-5).

It would have been obvious for one of ordinary skill in the art at the time the

invention was made to modify the previously mentioned combination with the teachings

of Bacon noted above. The skilled artisan would have been motivated to improve the

previously mentioned combination such that cycles in a reference counting garbage

collecting method could be detected (Bacon: paragraph [0019], lines 1-5).

Contact Information

Any inquiry concerning this communication or earlier communications from the

examiner should be directed to Patrick A. Darno whose telephone number is (571) 272-

0788. The examiner can normally be reached on Monday - Friday, 9:00 am - 5:30 pm.

If attempts to reach the examiner by telephone are unsuccessful, the examiner's supervisor, Safet Metjahic can be reached on (571) 272-4023. The fax phone number for the organization where this application or proceeding is assigned is 571-273-8300.

Information regarding the status of an application may be obtained from the Patent Application Information Retrieval (PAIR) system. Status information for published applications may be obtained from either Private PAIR or Public PAIR. Status information for unpublished applications is available through Private PAIR only. For more information about the PAIR system, see http://pair-direct.uspto.gov. Should you have questions on access to the Private PAIR system, contact the Electronic Business Center (EBC) at 866-217-9197 (toll-free).
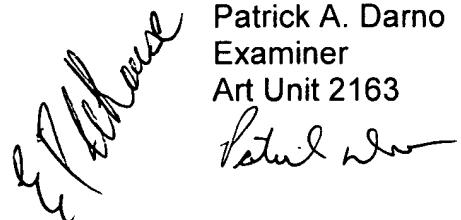
Patrick A. Darno
Examiner
Art Unit 2163

PD